

Physical Activity in Pregnancy and Its Association with Mode of Delivery and Delivery Outcomes in Hong Kong Chinese Women

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Objective: This study aimed to examine the effect of physical activity during pregnancy on the mode of delivery and delivery outcomes among Hong Kong Chinese women.

Methods: Self-administered questionnaires were distributed to pregnant women who presented to a regional hospital in Hong Kong in 2014. Women with a physical activity level of ≥ 7.5 compendium-based metabolic-equivalent mean weekly energy expenditure, which is equivalent to exercise at a moderate intensity for ≥ 30 min/day on most days of the week, were regarded as compliant with a recommendation of the American College of Obstetricians and Gynecologists (ACOG). Maternal characteristics, mode of delivery, and delivery outcomes were compared between women who were compliant and those who were non-compliant.

Results: The proportion of women compliant with the ACOG recommendation increased significantly as gestation advanced (from 23.6% in the first trimester to 30.3% in the second and 33.0% in the third, $p=0.005$). The mode of delivery differed significantly according to physical activity level in the third trimester ($p=0.016$), but not in the first ($p=0.366$) or second ($p=0.575$) trimester. Nonetheless, compliant and non-compliant women were comparable in terms of vaginal delivery, Caesarean section, and delivery outcomes.

Conclusion: Physical activity level in pregnancy is not associated with the rate of Caesarean section or adverse delivery outcomes.

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Introduction

In 2002, the American College of Obstetricians and Gynecologists (ACOG) recommended that women with low-to-moderate risk in pregnancy should exercise at a moderate intensity for ≥ 30 minutes/day on most days of the week¹. In December 2015, the ACOG adjusted the recommendation to a more manageable target of ≥ 20 to 30 minutes/day². Many studies have reported the benefits of physical activity during pregnancy, including improvement in general well-being³⁻⁵, prevention of excessive weight gain⁶, and reduction of obstetric risks such as gestational diabetes mellitus and pre-eclampsia^{7,8}. In addition, being physically active has not been shown to have any adverse effect on pregnancy or delivery outcomes such as gestational age, preterm delivery, birthweight, or Apgar score^{9,10}. Nonetheless, the effect of physical activity on the mode of delivery remains controversial, mainly because of the lack of large population-based studies and the presence of confounding factors. In a survey of 1342 women in North Carolina in 2004-2005, the self-reported frequency of exercise during pregnancy was not associated with a

reduced risk of Caesarean delivery¹¹. On the contrary, in a meta-analysis of 16 randomised controlled trials in 2014, structured physical exercise during pregnancy was associated with a reduced risk of Caesarean section¹².

A previous study reported attitudes towards and knowledge about physical activity, as well as patterns of physical activity during pregnancy in Hong Kong Chinese women¹³. The current study aimed to assess the association between the level of physical activity and the mode of delivery and delivery outcomes.

Methods

This study was approved by the ethics committee of the Kowloon Central Cluster of the Hospital Authority. From March to July 2014, self-administered semi-quantitative questionnaires in traditional Chinese were

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distributed to Chinese pregnant women when they attended the antenatal clinic of the United Christian Hospital, Hong Kong during their first trimester. Follow-up questionnaires were distributed in the second trimester at 24 to 28 weeks of gestation and in the third trimester at 32 to 40 weeks of gestation. The questionnaire was adopted from the Pregnancy Physical Activity Questionnaire, which has been validated by a Taiwan study¹⁴. The categorisation of approximate time spent per day or per week on household/caregiving activities, occupational activities, physical/exercise activities, transportational activities, and inactivity has been reported in another study¹⁵.

The compendium-based metabolic equivalent (MET) value was used to estimate the intensity of different types of physical activity¹⁶. The duration of time spent on each activity was multiplied by its intensity to arrive at a measure of mean weekly energy expenditure (MET-h/week). Women with a physical activity level of ≥ 7.5 MET-h/week (equivalent to exercise at moderate intensity for ≥ 30 min/day on most days of the week) were regarded as compliant with the 2002 ACOG recommendation.

Women were excluded if they had any absolute contraindication to exercise or previous Caesarean section or if they did not plan to deliver in our hospital. All women were routinely offered dating scans to determine their expected date of confinement during their first trimester Down's syndrome screening test. Demographic data (age, body mass index, parity, education level, occupation,

household income, history of miscarriage, previous low-birthweight baby) and obstetric and neonatal outcomes were retrieved from the hospital's computerised obstetric database and electronic antenatal record system.

The primary outcome was the mode of delivery in terms of normal vaginal delivery, instrumental delivery, and Caesarean section. The secondary outcome was delivery outcomes, including pregnancy duration, preterm birth, duration of the first and second stages of labour, Apgar score at 1 and 5 min, and birthweight.

Statistical analysis was performed using SPSS (Windows version 22; IBM Corp, Armonk [NY], US). Data were presented as percentage or median / interquartile range, as appropriate. Compliant and non-compliant women were compared using the Chi-square test (for categorical variables) or non-parametric Mann-Whitney *U* test or unpaired *t*-test (for continuous variables), as appropriate. A *p* value of <0.05 was considered statistically significant.

Results

Of 600 questionnaires distributed to eligible pregnant women, 534 (89%) in the first trimester, 261 (44%) in the second trimester, and 200 (33%) in the third trimester were adequately completed and returned. In the third trimester, the largest component of physical activity was household activities (42.5%), followed by occupational activities (21.4%), and physical and leisure activities (3.3%). The proportion of women who were

Table 1. Mode of delivery and the proportions of women who were compliant or non-compliant with American College of Obstetricians and Gynecologists (ACOG) recommendation for physical activity

Mode of delivery	No. (%) of women compliant with ACOG recommendation*		p Value
	Yes	No	
1st trimester (n=388)			0.366
Normal	63 (70.8)	227 (75.9)	
Instrumental	8 (9.0)	30 (10.0)	
Caesarean section	18 (20.2)	42 (14.0)	
2nd trimester (n=191)			0.575
Normal	37 (63.8)	95 (71.4)	
Instrumental	9 (15.5)	16 (12.0)	
Caesarean section	12 (20.7)	22 (16.5)	
3rd trimester (n=162)			0.016
Normal	35 (64.8)	81 (75.0)	
Instrumental	10 (18.5)	5 (4.6)	
Caesarean section	9 (16.7)	22 (20.4)	

* Percentages may not total 100 because of rounding

compliant with the ACOG-recommended physical activity level increased from 23.6% in the first trimester to 30.3% in the second trimester¹³ and 33.0% in the third trimester, with a linear-by-linear association (p=0.005). Among 388 women in the first trimester, 191 women in the second

trimester, and 162 women in the third trimester included for analysis, the mode of delivery differed significantly between women who were compliant or not in the third trimester (p=0.016) only, but not in the first (p=0.366) or second (p=0.575) trimester (Table 1).

Table 2. Characteristics of women who were compliant or non-compliant with American College of Obstetricians and Gynecologists (ACOG) recommendation for physical activity in the third trimester

Variable	Compliant with ACOG recommendation		p Value
	Yes (n=54)*	No (n=108)*	
Age (years)			0.923
≤20	1 (1.9)	2 (1.9)	
21-30	25 (46.3)	52 (48.1)	
31-40	27 (50.0)	50 (46.3)	
>40	1 (1.9)	4 (3.7)	
Parity			0.620
0	29 (53.7)	63 (58.3)	
1	19 (35.2)	34 (31.5)	
2	6 (11.1)	8 (7.4)	
3	0	3 (2.8)	
Occupation			0.825
Housewife	18 (33.3)	38 (35.2)	
Clerical work	13 (24.1)	28 (25.9)	
Manual work	0 (0)	2 (1.9)	
Professional	7 (13.0)	12 (11.1)	
Self-employed	2 (3.7)	6 (5.6)	
Others	13 (24.1)	18 (16.7)	
Did not specify	1 (1.9)	4 (3.7)	
History of miscarriage			0.778
0	35 (66.0)	74 (69.8)	
1	12 (22.6)	19 (17.9)	
≥2	6 (11.3)	13 (12.3)	
Education level			0.937
Primary	2 (3.7)	3 (2.8)	
Secondary	31 (57.4)	66 (61.1)	
Associate	7 (13.0)	9 (8.3)	
Tertiary or above	14 (25.9)	30 (27.8)	
Income (HK\$) [n=155]			0.120
≤20 000	31 (57.4)	70 (64.8)	
20 001-50 000	19 (35.2)	27 (25)	
>50 000	3 (5.6)	5 (4.6)	
Did not specify	1 (1.9)	6 (5.6)	
Body mass index (kg/m ²)	20.5 / 3.9	21.1 / 4.6	0.367
Previous low-birthweight baby	2 (3.7)	5 (4.6)	0.678

* Data are presented as No. (%) or median / interquartile range

Of 200 women who completed the questionnaire in the third trimester, 162 were included in the analysis and 38 were excluded (28 women with previous Caesarean section, four with placenta praevia, three with twin pregnancy, two with pre-existing hypertension, and one woman who did not deliver in our hospital). Of the 162 women, 54 (33.3%) were compliant with the ACOG recommendation and 108 (67.7%) were not. The two groups were comparable in terms of age, parity, occupation, history of miscarriage, education level, income, body mass index, and previous delivery of a low-birthweight baby (Table 2). The two groups were also comparable in terms of delivery outcomes, including pregnancy duration, preterm delivery, first-stage and second-stage duration, Apgar scores at 1 and 5 min, and birthweight (Table 3). Compliant and non-complaint women were comparable in term of vaginal delivery (83.3% and 79.6%, respectively, $p=0.674$). Nonetheless, compliant women had more instrumental deliveries than non-compliant women (18.5% vs. 4.6%, $p=0.004$), although the indications for instrumental delivery did not differ significantly (prolonged second stage: 70% [7/10] vs. 60% [3/5]; fetal distress: 30% [3/10] vs. 40% [2/5]).

Discussion

This is the first local study to investigate the relationship between physical activity during pregnancy and the mode of delivery and delivery outcomes. Compliance with the ACOG recommendation for physical activity during the third trimester increased the rate of instrumental delivery but did not affect the rate of Caesarean section or delivery outcomes. Physical activity in the first and second trimesters did not affect the mode of delivery.

The strength of our study is that it used the Pregnancy Physical Activity Questionnaire, which has been validated and widely used. It is a reliable tool to assess physical activity during pregnancy. The self-administered nature enables women to answer the questions at their convenience without interviewer bias. Women were asked to recall the data in the same trimester to maximise accuracy, and questionnaires were collected on the same day of distribution to maximise the response rate.

The finding of increased instrumental deliveries in women who were compliant with the ACOG recommendation in the third trimester is new. According to the ACOG, exercise is defined as physical activity consisting of planned, structured, and repetitive bodily movements to improve one or more components of physical fitness¹. Household, occupational, and transportational activities are not considered as exercise, although they may influence the mode of delivery. The distribution pattern of physical activity in women during the third trimester is similar to that in the first and second trimesters¹³. In a United States survey, the proportion of women who were compliant with the ACOG recommendation was 12.9% to 45.0% when active transport (walking or cycling) was included, compared with 12.7% to 28.9% when only sport activities were included¹⁷. Although non-exercise activities may not be as effective as physical activities in improving physical fitness, they may still play an important role in maintaining cardiorespiratory fitness and musculoskeletal condition during pregnancy. Considering that a large proportion of women performed routine household and occupational activities during pregnancy, these activities

Table 3. Delivery outcomes of women who were compliant or non-compliant with American College of Obstetricians and Gynecologists (ACOG) recommendation for physical activity in the third trimester

Variable	Compliant with ACOG recommendation		p Value
	Yes (n=54)*	No (n=108)*	
Vaginal delivery	45 (83.3)	86 (79.6)	0.674
Pregnancy duration (days)	276 / 8	274 / 8	0.178
Preterm	2 (3.70)	1 (0.09)	0.216
1st stage of labour (min)	287.5 / 225	272.5 / 260	0.235
2nd stage of labour (min)	16.5 / 37	10 / 24	0.261
Apgar score at 1 min	9.72 / 0.69	9.71 / 0.61	0.649
Apgar score at 5 min	9.98 / 0.14	9.90 / 0.39	0.143
Apgar score of <7 at 5 min	0	0	-
Birthweight (g)	3305.2 ± 381.3	3232.2 ± 359.4	0.234

* Data are presented as No. (%), median / interquartile range, or mean ± standard deviation

may have affected the mode of delivery. Exclusion of non-exercise activities may confound the mode of delivery and delivery outcomes.

In our study, the proportion of women compliant with the ACOG recommendation increased as gestation advanced (23.6% in the first trimester to 30.3% in the second and 33.0% in the third). This finding is in agreement with that of a cross-sectional survey in Taiwan, which reported an increase in the proportion of total energy expenditure in the physical/exercise category as pregnancy progressed, although this could reflect the behaviour of older and better educated participants in the third trimester¹⁸. In contrast, a cross-sectional study in Tianjin, China, reported the proportion of women meeting the ACOG recommendation being 11.6%, 11.3%, and 10.5% in each trimester¹⁹. In a cohort study in England, 48.8% and 48.9% of women spent ≥ 3 h/week on strenuous physical activity at 18 weeks and 32 weeks of pregnancy, respectively²⁰. In our study, fatigue was the main reason for limited exercise during the first trimester¹⁶. Hong Kong pregnant women are usually told to be on bedrest in the presence of threatened abortion in the first trimester. Closer to term, pregnant women are encouraged to walk or even climb stairs, which is believed to promote engagement of the fetal head and normal delivery. All these factors can account for the lower and higher rates of compliance with exercise recommendations in the first and third trimesters, respectively.

In our study, most pregnant women were not compliant with the ACOG recommendation. In a United States survey, the proportion of women fulfilling the

ACOG recommendation ranged from 12.7% to 28.9%¹⁷. In a study in China, only 9.1% to 10.7% of women participated in moderate physical activity during early pregnancy²¹. Higher education level, habitual exercise before pregnancy, and having a husband who exercised regularly increased the odds of fulfilling the ACOG recommendation¹⁷. More extensive local data are required to formulate strategies and interventions to promote exercise in pregnancy.

This study had several limitations. The response rate in the third trimester was only 33% (200 of 600) and the sample size was small. The low response rate was mainly because many women received antenatal care at other health centres, private hospitals, or in mainland China after the second trimester. Women who were lost to follow-up may have returned to our hospital only for check-ups until near term or on delivery. Some may have delivered in private hospitals. A reminder by telephone and mailing questionnaires to the women's home may have improved the response rate. Furthermore, there may have been reporting bias owing to the retrospective recall of data.

Conclusion

Physical activity during pregnancy is not associated with the rate of Caesarean section or adverse delivery outcomes. Our study supports the no-harm nature of exercise during pregnancy. Further studies on the benefits of specific types, duration, and intensity of exercise and their impact on delivery outcomes are warranted.

Declaration

All authors have disclosed no conflicts of interest.

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